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AUTHOR Furman, Duane E.; Noli, Pamala M.
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ABSTRACT

This study investigated the attitudes, behavior, and mathematics achievement of 200 second- through fifth-grade children who received a midmorning snack of nuts and raisins. It was hypothesized that a nutritious snack would counter low blood sugar in children who consumed a high-sugar breakfast or had no breakfast at all. Experimental subjects were randomly chosen from 2,000 students who received a snack and were compared with 200 randomly chosen controls who did not. In October and May, experimental and control groups were rated by their teachers on their classroom behavior and were administered the California Test of Basic Skills for Mathematics and the U.C.L.A. Test of Student Attitude. The experimental group showed more growth in mathematics scores over the year and somewhat less distracted and disruptive behavior, but these results were not statistically significant. However, the difference between experimental and control groups on the attitude scale was statistically significant for second and third graders. An unexpected finding was that attitudes were less positive at the end of the year for both groups of fourth through sixth graders. It was concluded that nutritious snacks were worthwhile minor intervention that used no instructional time. (CB)

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IMPROVING THE LEARNING AND ATTITUDES OF ELEMENTARY STUDENTS: A NUTRITION INTERVENTION

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A Study
Presented to
the Board of Trustees
of the
Madera Unified School District

The Madera Unified School District

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by
Duane E. Furman, Ed. D.
Pamala M. Noli, Ed. D.

Madera, California
December 1983

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Chapter 1

BACKGROUND

Introduction

Mid-morning snacks have been common practice in kindergarten and preschool classrooms for many years. When questioned about the rational for this practice, teachers explain that young children simply get hungry and can't wait until the lunch period, or teachers respond that this is the way it has always been done and it seems sensible to continue the practice.

Noted pediatrician, Dr. Lendon Smith, and theory from the nutrition field, provide rational for this practice which goes beyond "folk knowledge" and eludes to the value of a mid-morning nutritional snack as a catalyst for increased learning and improved student attitudes for older children as well as three through six year old.

Statement of the Problem

What effect does the intervention of a mid-morning snack of nuts and raisins have upon the learning, attitudes, and classroom behavior of children in grades one through six?

This inquiry evolved as a result of hearing Dr. Lendon Smith discuss his theories regarding the relationship between nutrition and a child's ability to learn in the classroom. His basic premise centers on the notion that many children

typically eat sugar saturated breakfasts which result in high blood sugar levels at the beginning of the school day but which take a rapid blood sugar level plunge about mid-morning, diminishing a student's ability to learn. He further theorized that a child's brain needs nourishment every two to three hours to function maximally.

The superintendent of the Madera Unified School District was intrigued with the possibility of increased learning, and proposed to Dr. Smith that the school district conduct an experimental study that would explore the effects of introducing a mid-morning snack of nuts and raisins to counteract the negative effects of high sugar content breakfasts or no breakfasts at all.

The superintendent approached the local Raisin Advisory Board and the Saulsbury Almond Company and was successful in obtaining approximately five hundred thousand individual packages of raisins and an equal number of almond packages to carry out the study over an eight month period. The growers were enthusiastic about the possibility that their products might contribute to higher learning and/or improved student attitudes.

Specific Questions

Questions that relate to the problem that was studied are:

1. What effect, if any, did the daily intervention of a mid-morning snack of nuts and raisins have upon the mathematics learning of children in grades two through six?

2. What effect, if any, did the daily intervention of a mid-morning snack of nuts and raisins have upon the attitudes of children in grades two through six?

3. What effect, if any, did the daily intervention of a mid-morning snack of nuts and raisins have upon the classroom behavior of children?

Definition of Terms

Nutritional Snack. A single serving, one half ounce package of almonds, and a single serving, one half ounce box of raisins.

Mid-morning. The time period following the first instructional hour when the nutritional snack was offered. Generally, the period between 9:30 and 10:15 a.m.

Basic Assumptions

The basic assumptions of this study are as follows:

1. If offered a nutritional snack of nuts and raisins at mid-morning, most children will desire and eat them.

2. The California Test of Basic Skills is a reliable and valid measure of mathematics learning.

3. Mathematics is the subject matter most often taught in elementary classrooms in late morning, prior to lunch.

4. If mathematics learning can be affected by the intervention of a mid-morning snack, other subjects taught in the time period following the intervention may be similarly affected.

5. The attitude surveys developed at U.C.L.A. are reliable and valid measures of attitudes for elementary students.

6. Teachers are accurate observers of pupils' behavior patterns.

7. Student attitudes affect student learning.

Scope and Dimensions of the Study

This study reports the effects of the intervention of a mid-morning snack of nuts and raisins on the mathematics learning, attitudes and classroom behavior of approximately two hundred students in the Madera Unified School District who were randomly selected from a population of approximately two thousand students in five schools. All two thousand students were served nuts and raisins daily from late October through June. A matched control group of approximately two hundred students were randomly selected from five other schools in the Madera Unified School District.

Pre-test data was collected in October, 1982 and included CTBS Mathematics Subtest, a student attitude test, and a student behavior questionnaire filled out by the teachers of the students in the sample.

Post test data was collected in late May, 1983 and included the same three instruments as were administered in October and to the same students.

The sample of students tested in the experimental and control groups represented approximately ten percent of the population. The population ranges from low to middle SES.

The grade levels represented in the experimental and control groups included grades two, three, four, five and six. Kindergarten and grade one students were not included in the samples due to the difficulty in finding cognitive tests that would accurately reflect learning at those levels.

Significance of the Study

As school districts pursue their continual search for ways to enhance student learning, the focus most naturally is on teaching strategies, curriculum development, and schc l delivery systems. Educators can control these variables. Although research clearly establishes the correlations between external variables such as SES, educational level of parents, health and other factors to learning and actitudes, educators feel powerless to change these variables.

The value of a school lunch has been recognized for years as important for the health and learning of students. Low SES schools also offer breakfast programs based on similar premises. If we accept the theory from the medical profession that the brain of a child need nourishment at least once every two hours to function at its potential level, then we must consider additional nutritional interventions.

As school districts consider extending the school day by implementing earlier starts and later dismissals, thus extending the times between breakfast and lunch and lunch and home arrival, the need for nutritional snacks may become an even more important consideration.

If the intervention of a nutritional snack can change the physiology of a child in a way that will improve his/her ability to learn, or if such an intervention can change his/her attitude and/or classroom behavior (intermediate variables) and thus improve the child's ability to learn, then such an intervention should be seriously considered as a viable expenditure of school district funds.

Chapter 2

REVIEW OF RELATED LITERATURE

A presentation by Dr. Lendon Smith, noted pediatrition and author, stimulated this study. In his various writings and taped lectures, Dr. Smith makes the following points:

1. A child must have a fully functioning brain to learn what he/she is being taught in the classroom.

2. The brain needs a constant supply of oxygen, water, amino acids, minerals, and a fairly consistent level of blood sugar to keep it operating optimally.

3. There is no storage for energy in the brain and a child's brain has two to three times the energy needs of the adult brain.

4. Many children have quick, sugary foods for breakfast. This may result, within thirty minutes, in a rapid rise of the blood sugar level to near diabetic levels. The pancreas then overresponds with an outpouring of insulin and the blood sugar level drops rapidly to below normal levels. The result of this rapid rise and fall of blood sugar levels often results in restlessness, anti-social actions, withdrawal and poor academic performance.

5. No teacher can effectively teach a child who cannot get along socially or pay attention to the lesson.

6. Most children need to nibble on good nourishing food every two to three hours to maintain the energy levels required by the brain and maintain even blood sugar levels.

7. The most convenient foods on which to nibble that would maintain a consistent blood sugar level needed by the brain for optimum function would be nuts, seeds and fruits; but meat, fish, fowl, eggs and cheese are all okay, albeit less manageable.

Dr. Smith goes into specific detail in his book Improving Your Child's Behavior Chemistry (1976). He has discovered that the human brain has the highest metabolic rate of any organ in the body and the child's brain has two to three times the energy needs of the adult. Frequent ingestion of foods that release energy slowly seems prudent. When the glucose level nourishing the brain drops from 150 milligram percent down to 60 milligram percent in a short period of time, the brain cannot function maximally. According to Dr. Smith:

> The suddeness of this drop is a threat to the body and stimulates the adrenal glands to secrete adrenaline and other hormones that release glucose from glycogen stores within the body, chiefly the liver.... It may be that children with sensitive nervous systems cannot handle sudden rises in quick sugar. Their bodies overreact to the sudden increase by excreting extra insulin. (Smith, 1976, p. 41).

Dr. Smith contends that poor parenting, family stress, depression of the mother and poor nutrition can all have a "deleterious and permanent effect on the developing brain." (1976, p. 147).

Watson (1972) agrees. He contends that when the glucose level is low, a food high in glucose is needed:

> Glucose is one of many kinds of sugar, but it is the principal fuel of the body. The brain and nervous system are almost totally dependent on it for normal functioning. (Page 2).

Watson further explains the brain's need for glucose:

> The source of all energy expended by the mind-considered as the function of the brain - is provided by a process called cellular respiration, during which complex foods are broken down into simpler substances which are then burned (oxidized) in the individual cells of the brain.
>
> The principal fuel of the brain is glucose... This is the material that is carried in the blood, the so called blood sugar, to all parts of the body's vital tissues. (1972, p. 21).

Dr. Watson points out that glucose can be obtained directly from honey, grapes and raisins, but must be manufactured by the body from most other foods.

Currier (1965) states that the brain appears to rely heavily on glucose for its energy, and, unlike other organs, it cannot switch to burning fat when sugar (glucose) isn't available.

Wohl (1960) points out that a blood sugar level of ninety is around normal. When the level dips to sixty-five or under, many children will have severe anxiety or depression. He suggests that increasing the glucose level to around ninety should improve children's feelings and attitudes about the environment.

There appears to have been no empirical studies conducted regarding the link between learning and attitudes and the intervention of a nutritional snack to counteract the physiological reactions explained on the previous pages.

An ERIC search undertaken in September of 1982 revealed no such studies.

Chapter 3

PROCEDURES

Introduction

The purpose of this study was to determine the effects of a daily nutritional snack of nuts and raisins on childrens' learning, attitudes and behavior.

The study was conducted during the 1982-83 school year in the Madera Unified School District in Madera, California. Students in grades two through six were studied.

Sample

The sample was made up of two hundred experimental group subjects and two hundred control group subjects randomly selected by the district computer from the five schools designated as experimental schools and the five schools designated as control schools. Schools were matched based on criterion from the 1981-82 school year and are illustrated in Table #I.

The Madera Unified School District is located in the Central San Joaquin Valley of California. The school district serves 10,366 students in grades kindergarten through twelve. The make-up of the attendance area includes the city of Madera with a population of 23,800 and a rural farming and bedroom community of approximately 450 square miles. The student population is 47 percent Spanish surnames, 4.9 percent Black,

TABLE #1

MATCHED PAIRS OF SCHOOL

EXPERIMENTAL GROUP	% Above Grade Level: CTBS (5/82)	Mean %ile: CTBS (5/82)	Percent AFDC	SES 1-3 Scale	Random Sample Mean Raw Score: CTBS - Math 10/82	Random Sample Mean Attitude Score: 10/82
1.A. Howard	77	69	6.2	2.45		
2.A Ripperdan	46	48	11.7	1.44		
3.A Adams	73	65	5.3	2.3		
4.A Madison	52	51	19.8	1.65		
5.A S.Vista	28	35	30.4	1.35		
A Means	55.2	53.6	14.68	1.838	26.0	12.6
CONTROL GROUP						
1.B. Dixieland	67	60	6.3	1.97		
2.B. LaVina	61	55	7.6	1.22		
3.B. Webster	69	63	4.7	2.5		
4.B. Monroe	55	53	11.8	1.81		
5.B. Washington	29	38	24.8	1.57		
B Means	56.2	53.8	11.04	1.814	26.1	13.6

1.1 percent Asian, .3 percent American Indian, and the remainder are Anglo. Of the 47 percent Spanish surnames, 5.6 percent are limited or non English speakers. Fourteen and five-tenths percent of the student population are migrant. The economy of the area is based on agribusiness. The working force is estimated to be 32 percent ranch owners and farm workers, 14 percent employed in industrial or service related jobs, and 11 percent professional. Fourteen and seven-tenths percent of the district enrollment receives Aid to Families with Dependent Children (AFDC), and 36 percent receive free lunches under the National School Lunch Program. Twenty eight percent of the pupils are project participants in Chapter I program and 3 percent are identified as Gifted and Talented.

Design of the Study

This study is quasi-experimental using a pretest, posttest, experimental, control format. The only intervention differentiating the experimental group from the control group was the mid morning snacks of nuts and raisins. Other than the original pairing of schools illustrated in Table #I, there was no attempt to control for other variables.

Instrumentation

The instruments used for pre and post data collection included:

1. CTBS - Mathematics subtests Form S, Level C,

Form S, Level 1 and Form S, Level 2.

2. U.C.L.A. Test of Student Attitudes - primary and upper grades forms (see appendix).

3. District made tests of teachers' observations of student behavior (see appendix). Teachers filled out a separate questionnaire, pre and post, on each child in the sample.

Data Collection

Two hundred second through sixth grade students were randomly selected for pre and post testing from the five experimental schools in September of 1982. The same number were randomly selected from the control schools.

The project director selected and trained ten volunteer parents to assist in the administration of the CTBS mathematics subtest and student attitude survey. The instruments were administered by the Project Director and the District Curriculum Coordinator over a ten day period during October, 1982. The twenty to thirty students selected from each school for testing were brought to their multipurpose rooms during morning hours and given the CTBS mathematics test which took about forty-five minutes and the attitude test which took between twenty and thirty minutes, depending upon the grade level. The attitude test was given orally with students responding in a yes/no format on answer sheets. One school was tested per day.

The Project Director met with the staff of each of

the ten schools during the first two weeks of October to explain the study, testing, and for completion of the teacher questionnaires. Additional time was taken at the meetings with the five experimental school staffs to determine procedures for the delivery, handing out and eating of the nuts and raisins. The teachers completed the student behavior questionnaires during the fourth week in October. A sample of the experimental teachers were asked to keep track of the students in their class who were in the random sample of students for testing to determine the number of times children actually ate the nuts and raisins as compared to the number of times they were offered.

During the last two weeks in May, the Project Director, Curriculum Coordinator and the same volunteer parents administered the student attitude survey in the same formats as described for the pretests. The CTBS portion of the post test data collection was given in the classrooms in April as a regular part of the district's spring testing with all subtests of the CTBS.

Teachers filled out the post student behavior questionnaire during the third week in May, 1983.

Treatment of the Data

Student and teacher responses on all three instruments, pre and post, were recorded on computer scan sheets. The District computer compiled raw pre, post and growth scores on

CTBS which were transferred to key punch cards by a commercial company along with all item responses on the attitude surveys, item responses on the student behavior surveys, and student data such as grade, school and ethnic background. These cards were processed by the computer at the California State University at Fresno using the S.P.S.S. (Statistical Package for the Social Sciences).

Limitations

The findings of this study may have generalized applicability to populations similar to the sample and may extend to kindergarten and grade one. The random sample represented approximately ten percent of the population. Schools were matched in pairs for inclusion in the study and the determination of which of the two schools in each pair would be in the experimental group was at the discretion of the Project Director and principals. Teachers' interest in the project was not taken into consideration when deciding which schools (teachers and children) would receive the nuts and raisins.

The cognitive growth instrument (CTBS) is reliable and valid, but may not be sensitive enough to reflect this intervention. The possibility that a teacher may have chosen not to teach mathematics during the instructional period following the snack would also invalidate the use of a mathematics test to reflect cognitive growth changes as a result of an intervention that might only have potential effect on spelling and English.

The Attitude Survey has been widely used and is reliable and valid. If student attitudes can be changed by a nutritional intervention, as reflected by this instrument, generalizability to larger populations and even diverse populations is feasible.

Since the student behavior questionnaire was locally developed and has no field testing to establish degree of reliability or validity, findings based on it should be used strictly for further investigations, although it is the belief of the project team that the instrument does indeed measure student behavior.

Chapter 4

FINDINGS

Mathematics growth based on the California Test of Basic Skills and Attitude Growth based on the U.C.L.A. Attitude Survey are illustrated in Table #2. The numbers reflect the raw score differences between the pretest and post test.

Table #3 relates the sum, mean, standard deviation, variance and number of students in the entire populations for each test.

Growth in mathematics was greater for the experimental group at all grade levels except grade five, but none of the mathematics growth scores were statistically significant. That is to say, the slightly higher math scores found for the experimental group could have occurred by chance.

Growth in student attitudes also shows more positive student attitudes for the experimental group again with the exception of grade five. However, the gain for grade two was statistically significant at the .001 level. When grades two and three are combined to reflect gain scores for primary students, the experimental group was significantly higher at the .003 level. In other words, it is highly unlikely that the higher attitude scores of the experimental primary students could have occurred by chance. Although the 2.7 growth score difference at grade four appears at first glance to be potentially

TABLE #2

MATHEMATIC AND ATTITUDE GROWTH

GRADES	MATHEMATICS	ATTITUDE
Grade 2 Experimental	10.5	1.2
Grade 2 Control	9.2	- 3.5
Grade 2 Experimental minus Control	+ 1.3	+ 4.7
Grade 3 Experimental	11.4	2.7
Grade 3 Control	10.8	1.0
Grade 3 Experimental minus Control	+ 0.6	+ 1.7
Grade 4 Experimental	8.9	0.0
Grade 4 Control	7.7	- 2.7
Grade 4 Experimental minus Control	+ 1.2	+ 2.7
Grade 5 Experimental	4.1	- 2.0
Grade 5 Control	6.7	- 0.1
Grade 5 Experimental minus Control	- 2.6	- 1.9
Grade 6 Experimental	4.5	- 1.2
Grade 6 Control	1.9	- 1.6
Grade 6 Experimental minus Control	+ 2.6	+ 0.4

TABLE #3

ENTIRE POPULATION STATISTICS GROWTH

		Sum	Mean	St.*	Variance	N
Mathematics	Grades 2,3 Experimental	718	10.8788	6.2623	39.2159	66
	Grades 2,3 Control	646	10.0938	6.6302	43.9593	64
Attitude	Grades 2,3 Experimental	123	2.1964	5.1396	26.4153	56
	Grades 2,3 Control	- 78	-1.2381	6.9786	48.7005	63
Mathematics	Grades 4,5,6 Experimental	555	5.6633	6.3764	40.6586	98
	Grades 4,5,6 Control	479	5.3222	6.7522	45.5916	90
Attitude	Grades 4,5,6 Experimental	-136	-1.1930	11.3378	128.5465	114
	Grades 4,5,6, Control	- 7	- .0648	13.5248	182.9210	108

*Standard Deviation

significant, it must be remembered that the primary attitude survey has only thirty seven questions compared to the seventy questions found on the fourth through sixth grade instrument. Therefore, a difference in gain scores of plus 1.7 on a thirty seven item instrument is more powerful than a 2.7 difference in gain scores on a seventy item instrument.

Although not necessarily pertinent to this study, it is interesting to note that post attitude scores were consistently lower than the pre-attitude scores in upper grades indicating that intermediate age youngsters feel less positive about their school, teachers, peers and classroom work in the spring at the end of the school year than they do in the fall when school has just begun.

Based on the significant experimental group finding in attitudes for grades two and three, a further investigation of the data was undertaken. The response items on both the primary and intermediate instruments were subdivided into the four categories shown in Table #4.

TABLE #4

ATTITUDE SURVEY: SUB-GROUPS

Grade Level	Sub-Group	Pre-Test	Post-Test	Gain	Significance
2,3	Student Attitudes about Teachers	E= .09 C= -.06	3.5 - .16	2.6 -0.1	.005
2,3	Student Attitudes about Peers	E= 0.5 C= 0.5	0.6 0.2	0.1 - .3	
2,3	Student Attitudes about School	E= 8.8 C= 8.9	10.6 8.6	1.8 -0.3	.005
2,3	Student Attitudes about Classroom work	E= 9.2 C= 9.6	9.7 8.9	0.5 -0.7	
4,6	Student Attitudes about Teachers	E= 2.3 C= 2.4	2.3 1.3	0 - .9	
4,6	Student Attitudes about Peers	E= 0.3 C= 0.7	0.2 0.4	-0.1 -0.3	
4,6	Student Attitudes about School	E= 3.3 C= 3.5	5.1 4.9	1.8 1.4	
4,6	Student Attitudes about Classroom work	E= 2.7 C= 2.7	2.4 2.3	-0.3 -0.4	

E= EXPERIMENTAL GROUP
C= CONTROL GROUP

Although the Experimental Group showed more positive (or less negative) attitudes in all four categories at all grades, Experimenal Group Attitudes about Teachers and about School were significantly more positive for grades two and three. Those same two categories, Teachers and School, had the largest gain, but not to a significant level, for the Experimental Group in the intermediate grades.

The intervention of a mid-morning snack of nuts and raisins does have a positive effect on the attitudes of primary students, particularly as those attitudes relate to their teachers and school in general. The same effect may or may not result in grades four, five and six.

Correlations were run on mathematics growth, attidues growth, pre and post mathematics and pre and post attitude scores. Table #5 illustrates those correlations. Empty cells in Table #5 reflect correlations lower than .15.

TABLE #5

CORRELATIONS

	Primary (2.3)					
	Math Growth	Attitude Growth	Pre Attitude	Post Attitude	Pre Math	Post Math
Math Growth	//////	E= .385	C= -.184	E= .240	E=-.356 C=-.402	E=.234 C=.237
Attitude Growth		//////	E= -.648 C= -.365	E= .239 C= .559	E= .188	C=.173
Pre Attitude			////////	E= .585 C= .567	E= .186	E=.155
Post Attitude				///////	C= .276	E=.195 C=.240
Pre Math					///////	E=.825 C=.794
Post Math						//////

Intermediate (4,5,6)

Math Growth	//////				C=-.459	
Attitude Growth		//////		E= .525 C= .628		
Pre Attitude		E=-.461 C=-.415	////////	E= .527 C= .464		E=.202 C=.176
Post Attitude				///////	E= .205	
Pre Math	E=-.501 C=-.459				///////	E=.749 C=.754
Post Math	E= .201 C= .236					//////

E = EXPERIMENTAL GROUP C = CONTROL GROUP

There are a few correlations from Table #5 that are noteworthy. In both primary and upper grades, correlations were found between attitudes and mathematics achievement. Children in both the Control and Experimental Groups who had higher attitudes also had higher math scores. The highest correlation between attitudes and mathematics achievement was .385 for the Experimental Group. Experimental children with high attitude growth also had high mathematics growth in primary grades. This was not true for the Control Group.

Tables #6 and #7 report the results of the Teacher Questionnaire regarding the classroom behavior of their sample students.

TABLE #6

TEACHER QUESTIONNAIRE

Pupil Behavior

Grades Two and Three

ITEM DESCRIPTION		PRE	POST	GAIN
(1) Trips to the toilet, fountain, pencil sharpener. Restless, fidgets, out of seat (1-no; 2-some; 3-excessive)	E	1.6	1.5	- .1
	C	1.5	1.5	0
(2) Distractability: Disturbed by others, small noises or movements, confused by group activities or open classroom. Better in 0-to-1 relationships. Unable to cope with situations. (1-no; 2-some;3-true)	E	1.7	1.7	0
	C	1.5	1.6	- .1
(3) Talks, disturbs, touches, pushes, fights. Few Friends, class clown. (1-no; 2-some; 3- a lot)	E	1.4	1.5	.1
	C	1.4	1.5	.1
(4)Goofs off, unfinished work, no responsibility for own work (1-never; 2-some; 3-frequent)	E	1.5	1.8	.3
	C	1.6	1.6	0
(5) Fine motor skills (1 - adequate; 2 - poor)	E	1.3	1.2	- .1
	C	1.1	1.1	0
(6) Gross motor skills (1 - adequate; 2 - poor)	E	1.1	1.0	- .1
	C	1.0	1.0	0
(7) Assessment of native intellectual potential (1-average or above; 2-less than adequate)	E	1.2	1.1	- .1
	C	1.1	1.1	0
(8) Time-on-task (1-high; 2-average; 3-off task most of time)	E	1.9	1.8	- .1
	C	1.7	1.9	.2

TABLE #7

TEACHER QUESTIONNAIRE

Pupil Behavior

Grades Four, Five, Six

ITEM DESCRIPTION		PRE C	POST D	GAIN
(1) Trips to the toilet, fountain, pencil sharpener. Restless, fidgets, out of seat (1-no; 2-some; 3-excessive)	E	1.5	1.5	0
	C	1.8	1.7	- .1
(2) Distractability: Disturbed by others, small noises or movements, confused by group activities or open classroom. Better in 0-to-1 relationships. Unable to cope with situations. (1-no; 2-some;3-true)	E	1.6	1.6	0
	C	1.7	2.0	.3
(3) Talks, disturbs, touches, pushes, fights. Few Friends, class clown. (1-no; 2-some; 3- a lot)	E	1.4	1.5	.1
	C	1.6	1.5	- .1
(4)Coofs off, unfinished work, no responsibility for own work (1-never; 2-some; 3-frequent)	E	1.7	1.6	- .1
	C	1.7	1.8	- .1
(5) Fine motor skills (1 - adequate; 2 - poor)	E	1.1	1.1	0
	C	1.2	1.1	- .1
(6) Gross motor skills (1 - adequate; 2 - poor)	E	1.1	1.0	- .1
	C	1.1	1.0	- .1
(7) Assessment of native intellectual potential (1-average or above; 2-less than adequate)	E	1.1	1.0	- .1
	C	1.2	1.2	0
(8) Time-on-task (1-high; 2-average; 3-off task most of time)	E	1.8	1.7	- .1
	C	1.8	1.9	.1

None of these scores are significant. The only differentiations between the Control Groups and Experimental Groups in grades two and three are a slightly higher rate of unfinished work, etc. (Item #4) for the Experimental Group and a slightly higher rate of time-on-task (Item #8) for the Experimental Group. These are contradictory findings and the gain score differences are minimal. Table #7 shows even less variance between the groups at upper grades. The Experimental Group appears to have been less distractible, etc. (Item #2), less disruptive (Item #3) and had higher rates of time-on-task (Item #8), but these differences could have occurred by chance.

Discussion of Questions

The specific questions posed by this study were three in number:

Question 1: What effect, if any, did the daily intervention of a mid-morning snack of nuts and raisins have upon the mathematics learning of children in grades two through six?

No significant difference was found between the children who received the nuts and raisins and those who did not. Four of the five grade levels showed higher mathematics achievement for the children who received the nuts and raisins over those who didn't, but statistically, this could have occurred by chance.

Question 2: What effect, if any, did the daily intervention of a mid-morning snack of nuts and raisins have upon the attitudes of children in grades two through six?

Primary children who received nuts and raisins had significantly better attitudes than did their counterparts who did not receive the snacks. The greatest and significant effect was upon the childrens' attitudes about their teachers and school and a smaller effect, but still positive, was toward their peers and school work.

There was no significant effect of nuts and raisins relative to the attitudes of upper graders. but attitudes were more positive (less negative) at grades four and six.

Correlations of .385 were found between attitude growth and mathematics growth in the nuts and raisins group and .240 between post attitude scores and math growth for the same group in primary grades. The correlations between attitudes and math that are shown on Table #5 for both groups are also important in that they reaffirm previous research findings that report the relationship between the positive achievement effects which result from improved student attitudes.

Question 3: What effect, if any, did the daily intervention of a mid-morning snack have upon the classroom behavior of children?

No significant differences were found.

CHAPTER 5

SUMMARY AND CONCLUSIONS

Summary

The study was undertaken in order to attempt to determine if offerings of nutritious snacks of fruit (raisins) and nuts (almonds) would have a positive (increased growth) effect on student progress in mathematics achievement and improvement in attitudes and behavior. Schools were paired and achievements of random samples of students in project schools in mathematics, behavior and attitudes were compared with achievements of students in the control schools.

The hypothesis was that such offered snacks at mid morning would cause a measurable increase in mathematics achievement and a positive improvement in behavior and attitudes.

The snacks were offered to students on a voluntary or observed need basis by the teachers or classroom aides

Pre and post tests were administered to the students in the sample by a team of volunteers in the fall of 1982 and the spring of 1983. Results of the testing were run through computers at the school district and California State University, Fresno and analyzed.

Results of the study indicated a generally beneficial (improved comparative mathematics scores and behavior) result from project participants though often not at a statistically significant level.

Conclusions

A mid morning snack of nutritious food, in this case almonds and raisins, did result in improved mathematics and behavior scores of project participants over those of students in the control schools. Experimental Group attitudes about their teachers and schools increased significantly in primary grades. Although the fourth through sixth grade attitude scores declined overall in the spring, the Experimental Group's scores showed less decline than the Control Group's scores.

The correlation between achievement and attitude scores has been established in other studies. Since it is quite possible that CTBS Mathematics Subtest was not a sensitive enough instrument to detect cognitive differences, and since we do know that the U.C.L.A. Student Sentiment Index (see Appendix B) is valid, reliable and not subject to the CTBS shortcomings discussed in Chapter 3 (Limitations), the significant attitude change is the most important finding of this study.

There are perhaps a number of interventions into a school environment that could improve student attitudes, but most would require a considerable payoff in instructional

time that could negate the positive effect of the intervention as it relates to cognitive learning. For instance, a school could institute video games in the classrooms, have parties and rallies every week, and extend recesses by twenty minutes a day. Student attitudes about school might well improve, but the loss of instructional time would invalidate the correlation between attitude and achievement.

The nutritional snack intervention, however, took little, if any, instructional time. Students generally picked up the nuts and raisins on their way out to recess or received them as they entered the class at 8:30 a.m., put them in their desks, and then nibbled on them from about 9:30 to 10:00 a.m. as instruction was taking place. None of the fifty two teachers in the experimental schools complained of lost instructional time or that the nuts and raisins nibbling was a disruptive factor.

For such a minor intervention, in terms of time and logistics, to significantly effect students attitudes about their school makes this project worth serious consideration for future implementations.

As an aside, the nutritious snacks were also provided to all students in the district involved in Special Education (Learning Handicapped, Severely Learning Handicapped and Mentally Retarded Students). Almost from the beginning of the project, Special Education teachers remarked regarding the decrease in behavior problems and

anti-social behavior among their students. Credit for this improvement in behavior was given by the teachers to sharing the nutritious snacks, but no pre or post data was collected that would confirm these verbal teacher observations. The small supply of nuts and raisins left at the conclusion of the study were given to Special Education teachers, at their request, for their students.

Limitations

The study was limited to students in grades two through six as indicated. A limited random sample was taken of those students participating in the project. Some movement of students between schools doubtless occurred during the period of the study.

Conditions other than those happening at school, affect student learning attitudes and behavior.

Testing was administered in the fall of the year and again the following spring. Beginning the project in the spring, including testing, and concluding the following fall or winter, was not tried. Different attitude scores may have resulted under this procedure.

The tests, except for the mathematics post tests, were not administered by certificated staff but by trained volunteers under the supervision of certificated staff.

A major shortcoming of the design was not requiring that all teachers in the Experimental and Control Groups

teach mathematics during the last half of the morning after the nuts and raisin snack. Based on the assumption that most teachers teach math during this later period, the CTBS Mathematics subtest was chosen as the instrument by which cognitive growth would be judged. We now know that at least some of the teachers in the study taught mathematics during the first hour of the day, making the CTBS Mathematics test totally unrealiable and unresponsive to the intervention.

Implications for Practice

Students do come from diverse home environments and different food and eating patterns. Their ability to learn what is being taught is affected by body condition. Nutritious snacks offered at mid morning may help to achieve, maintain or heighten the ability to concentrate and achieve.

Recommendations

This study should be replicated in a variety of socio-economic areas at different times of the school year, and at different grade levels.

Careful consideration should be given to the negative shift in attitudes in grades four, five and six that occurred between the fall and the spring in both the Experimental and Control Schools. This data is a by-product of the study, but an important one. We can make some assumptions about the reasons that older children may feel more negative about their

schools near the end of the school year such as the fact that students are generally enthusiastic and positive about school when they begin but are tired and anticipating the summer break by late spring. However, this finding should stimulate further questions such as what other factors contribute to declining student attitudes at the end of the year; what, if anything, can we do to counteract those factors, and what new strategies can we employ during the spring months to enhance positive attitudes and keep morale high?

Subject matter, behavior and attitudinal tests other than those administered in this study, should be tried. Physical performance in specific areas would be an interesting area of study.

School districts, following further testing, may well wish to consider obtaining from federal sources or purchasing and providing mid-morning nutritious snacks to students to achieve the three goals of enchanced positive attitudes, behavior and achievement as addressed in this study.

Observations

We're glad we did the study. Teachers in the district had for years expressed concern about students who "dulled out" by mid-morning, were obviously hungry when they came to school, or were "hyper" early in the school day due to the type of breakfast consumed.

Educators are anxious to succeed in their appointed teaching tasks. The nuts and raisins took little time to distribute and eat (sometimes in the classroom, other times at recess) and they certainly helped those students needing the energy and provided a pleasant supplement for the others.

An interesting aspect of the experience was the feeling of "family" or "sharing" caused by the partaking of food together, by the class and often the teacher. The partaking of food together has been a symbol of sharing and peace for a long time in many societies. In our modern United States, an increase has been noted of single parent families and families where both parents find it necessary, or choose, to work. In at least some cases, this results in a lessening of parent-child contact where communication, sharing of thoughts, counseling, apprenticeship and other important communication and just "being together", normally occurs.

In a number of cases, parent or parents leave for work in the morning well before the students leave for

school or the bus stop, and the student arrives home in the afternoon well before the parent or parents. Project "Nibble" seemed, in many cases, to help provide a feeling of togetherness and sharing that helped --- an added bonus to the achieving or maintenance of a physical balance conducive to learning.

We wish we could do it all the time throughout the school year. The federal government's interest in strongly encouraging breakfast programs in the public schools of our country appears to indicate an awareness of the wide variety of food habits existent.

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APPENDICES

APPENDIX A

SCHOOL SENTIMENT INDEX
PRIMARY LEVEL

SCHOOL SENTIMENT INDEX

Primary Level

Questions:

(face)	1.	Is your teacher interested in the things you do at home?
(star)	2.	When you are trying to do your schoolwork, do the other children bother you?
(bell)	3.	Does your teacher care about you?
(cat)	4.	Do other children get you into trouble at school?
(phone)	5.	Do you like being in school?
(flower)	6.	Would you be happier if you didn't have to go to school?
(clown)	7.	Does it bother you because your teacher doesn't give you enough time to finish your work?
(house)	8.	Are the grown-ups at school friendly toward the children?
(dog)	9.	Do you like to read in school?
(umbrella)	10.	When you don't understand something, are you usually afraid to ask your teacher a question?
(face)	11.	Are the other children in your class friendly toward you?
(star)	12.	Are you scared to go to the office at school?
(bell)	13.	Do you like to paint pictures at school?
(cat)	14.	Do you like to write stories in school?
(phone)	15.	Is school fun?
(flower)	16.	Does your teacher like to help you with your work when you need help?
(clown)	17.	Do you like doing arithmetic problems at school?

(house)	18.	Are the rooms in your school nice?
(dog)	19.	Do you like to learn about science?
(umbrella)	20.	Do you like to sing songs with your class?
(face)	21.	Does your school have too many rules?
(star)	22.	Do you usually do what other children want to do instead of what you want to do?
(bell)	23.	Do you like the other children in your class?
(cat)	24.	Would you like to be somewhere other than school right now?
(phone)	25.	Does your teacher like some children better than others?
(flower)	26.	Do other people at school really care about you?
(clown)	27.	Does your teacher yell at the children too much?
(house)	28.	Do you like to come to school every day?
(dog)	29.	Does your teacher get mad too much?
(umbrella)	30.	Do you feel lonely at school?
(face)	31.	Do you have your own group of friends at school?
(star)	32.	Do your classmates listen to what you say?
(bell)	33.	Do you like to learn about other people?
(cat)	34.	Do you wish you could stay home from school a lot?
(phone)	35.	Is school boring?
(flower)	36.	Are there a lot of things to do at school?
(clown)	37.	Do nice things happen at your school every year?

APPENDIX B

SCHOOL SENTIMENT INDEX

Intermediate Level

Directions: On your answer sheet, please show whether each of these sentences is true or untrue for you by marking A (true) if the sentence is true or B (untrue) if it is not true.

For example:

	A	B	
1.	True : :	Untrue	1. My class is to easy.
2.	True	Untrue : :	2. I'd like to stay at school always.

There are no right or wrong answers, so respond to each item as honestly as you can.

1. Other children bother me when I'm trying to do my school work.
2. My teacher always tries to tell me when he (she) is is pleased with my work.
3. My teacher is interested in the things I do outside of school.
4. Each morning I look forward to coming to school.
5. In my class, my teacher allows us to make many decisions together.
6. Other children often get me into trouble at school.
7. My teacher doesn't explain things very well.
8. My teacher listens to what I have to say.
9. It is hard for me to stay happy at school because I wish I could be somewhere else.
10. When I do something wrong at school, I know I will get a second chance.
11. My teacher tries to make school interesting to me.
12. Most school days seem like they will never end.
13. My teacher does not care about me.
14. I don't like having to go to school.
15. The grown-ups at my school are friendly.
16. My teacher gives me as many chances as other children to do special jobs in my classroom.
17. The other children in my class are not friendly toward me.
18. My teacher tries very hard to help me understand hard schoolwork.
19. I like to do my homework.
20. My teacher doesn't understand me.
21. I often wish I was somebody who doesn't have to go to school.
22. This school has events all the time that make me happy I attend school here.

23. My teacher treats me fairly.

24. My teacher tries to make sure I understand what he (she) wants me to do.

25. I really like working with the other children in my class.

26. I'm afraid to tell my teacher when I don't understand something.

27. I feel good when I'm at school because it's fun.

28. I get scared when I have to go to the office at school.

29. My teacher unfairly punishes the whole class.

30. My teacher doesn't give very good tests.

31. School is a good place for making friends.

32. My teacher tries to do things that the class enjoys.

33. I'm scared of my teacher because he (she) can be mean to us.

34. I like to stay home from school.

35. When I have a problem on the playground at recess, I know I can find someone to help me.

36. I don't like most of the children in my class.

37. My teacher is not very friendly with the children.

38. The biggest reason I come to school is to learn,

39. My school looks nice.

40. My teacher grades me fairly.

41. I like doing math problems.

42. I feel like my teacher doesn't like me when I do something wrong.

43. I like reading.

44. When a new child comes into our class, my friends and I try very hard to make him or her feel happy.

45. My teacher likes some children better than others.

46. I feel unhappy if I don't learn something new in school each day.

47. When I do something wrong, my teacher corrects me without hurting my feelings.

48. I like school because there are so many fun things to do.

49. I like writing.

50. My teacher is often too busy to help me when I need help.

51. It would be nice if I never had to come back to school again after today.

52. My teacher doesn't want to hear the children's ideas on classroom rules and behavior.

53. My teacher usually explains things too slowly.

54. Older children often boss my friends and me around my school.

55. I don't think there is very much to do at this school.

56. My teacher bosses the children around.

57. My teacher gets angry if the class isn't quiet.

58. My teacher usually doesn't know what to do in class.

59. I like my teacher because he (she) is understanding when things go wrong.

60. If I had a problem outside of school, I could go to my teacher for help.

61. My teacher cares about the feelings of the pupils in his (her) class.

62. My teacher doesn't care what happens to me outside of school.

63. My teacher is usually grouchy in class.

64. I have my own group of friends at school.

65. I like to work with other children on class projects.

66. Learning new things is not very much fun.

67. When my schoolwork is hard, I don't feel like doing it.
68. I don't do very much reading on my own.
69. Almost everything I learn in school is dull.
70. I don't care what scores I get on my schoolwork.
71. I would rather do almost anything else than study.
72. I'm very happy when I'm at school.
73. School is exciting.
74. I don't like school because it's too much work.

APPENDIX C

TEACHER QUESTIONNAIRE

Dr. Lendon Smith Project

Please print the student's name, grade and school on the computer form.

1. Activity: Trips to the toilet, fountain, pencil sharpener. Restless, fidgets, out of seat.

   A - No B - Some C - Excessive

2. Distractability: Disturbed by others, small noises, or movements, confused by group activities or open classroom. Better in one-to-one relationships. Unable to cope with new situations.

   A - No B - Some C - True

3. Social: Talks, disturbs, touches, pushed, fights. No friends. Class clown.

   A - No B - Some C - A lot

4. Work: Goofs-off, unfinished work, asks questions. No responsibility for own work.

   A - Never B - Some C - Frequent

5. Fine motor skills:

   A - Adequate B - Poor

6. Gross motor skills:

   A - Adequate B - Poor

7. General assessment of native intellectual potential:

   A - Average or above B - Less than adequate

8. Time - on - Task:

   A - High B - Average C - Off-task most of time

9. General health of the child is:

A - Good (very few absences; high energy; good color)

B - Poor (excessive absences due to illness; listless; poor color on occasion)

10. Is the child ticklish:

A - Yes B - No

11. How many hours sleep does he/she get on school nights? (Ask the child).

A - Over 10 B - 8-10 C - Less than 8

12. Eye color:

A - Blue B - Green C - Hazel D - Other

Thank you for your time in completing this questionnaire. Dr. Furman, Dr. Smith and I are most appreciative of your help.

Sincerely,

Pamala Noli, Ed. D.
Project Coordinator

LENDON H. SMITH, M.D.
2200 S.W. MARKET ST. DRIVE
PORTLAND, OR 97201

PROJECT NIBBLE

Dear Dr. Furman,

I am delighted with the study that you completed at your schools. I know that nutrition is not the whole answer to everything, and I would have been surprised if this project "NIBBLE" corrected all the academic and behavioral problems in the experimental school.

It was carefully organized and, it seems, faithfully carried out. It gives me enough encouragement to continue to promote better nutrition for all. The findings fit my research: the children whom the teachers identify as being at academic risk with short attention spans, disruptive behavior and those who do better with smaller classrooms and individual attention, are the ones who would more likely be suffering from blood sugar fluctuations and would profit from a sustaining snack at midmorning.

No teacher should be required to teach a child who did not bring his/her brain to school. Self-control, attitudes and academic skills are functions of the neocortex and it must be constantly nourished.

The attitude change in the experimental group is an important observation given the amount of adverse criticism aimed at the whole shool system in the last few years. The study serves to indicate to some degree that the underachieving child may be more a product of the diet than of the teacher's classroom skills. At the present the teacher's time has to be devoted to discipline and baby sitting; education may follow. This study helps to indicate an inexpensive, simple approach might control a few classroom problems.

The Norwegian government provides a bit of fish and a piece of cheese to every school child at 9:30 A.M. School administrators, teachers and psychiatrists deny that they have problems with hyperactivity or discipline. Maybe a more substantial snack would have improved the statistics in this study. Maybe each child should have had his/her own ethnic snack.

You have done a great service for the education of children in America.

Thank you and keep me informed as to the next step.

Sincerely,

Lendon H. Smith, MD.